WHAT IS CLAIMED IS:

1. An electrosurgical instrument for delivering energy to tissue, comprising:

a working end for engaging the tissue;

a surface layer at an exterior portion of the working end, the surface layer comprising a matrix of polymeric PTC composition adapted to deliver electrical current to the tissue; and

a cooling structure at an interior portion of the working end;

wherein the cooling structure cools the PTC matrix to lower the temperature of one or more portions of the PTC matrix.

2. The electrosurgical instrument of claim 1, wherein the PTC matrix defines a switching range at which the electrical resistance substantially increases in a selected temperature range.

3. The electrosurgical instrument of claim 2, wherein the surface layer has a thickness of less than about 500 microns.

4. The electrosurgical instrument of claim 3, wherein the surface layer has a thickness ranging between about 0.1 microns and 200 microns.

5. The electrosurgical instrument of claim 4, wherein the surface layer has a thickness ranging between about 0.5 microns and 100 microns.

6. The electrosurgical instrument of claim 1, wherein the cooling structure passively cools the PTC matrix.

7. The electrosurgical instrument of claim 6, wherein the cooling structure comprises a thermally conductive material forming an electrode which conducts electrical current from a power source to the PTC matrix.

8. The electrosurgical instrument of claim 7, wherein the cross-section of the conductive portion is significantly larger than the PTC surface layer.

9. The electrosurgical instrument of claim 7, wherein the cooling structure comprises a material selected from a group consisting of copper-beryllium alloy, copper, aluminum, silver, or gold.

10. The electrosurgical instrument of claim 7, further comprising a ground electrode, and wherein the power is supplied to the thermally conductive electrode in a mono-polar configuration.

11. The electrosurgical instrument of claim 1, wherein the cooling structure actively cools the PTC matrix.

12. The electrosurgical instrument of claim 11, wherein the cooling structure communicates with a fluid-cooling circulation system.

13. The electrosurgical instrument of claim 12, further comprising a fluid source, wherein the cooling structure has a flow channel to form a flow loop through which the fluid source circulates a fluid.

14. The electrosurgical instrument of claim 13, further comprising a heat exchanger, wherein the fluid pump circulates the fluid through the heat exchanger.

15. The electrosurgical instrument of claim 13, wherein the fluid comprises water.

16. The electrosurgical instrument of claim 13, wherein the fluid comprises a cooling gas.

17. The electrosurgical instrument of claim 16, wherein the cooling gas comprises a cryogen selected from the group consisting of freon or CO_2.

18. The electrosurgical instrument of claim 17, further comprising an expansion chamber, wherein the cooling gas absorbs heat as it changes its phase state while in the expansion chamber.

19. The electrosurgical instrument of claim 18, further comprising an inflow channel and outflow channel for circulating the gas between the fluid pump and the expansion chamber.

20. The electrosurgical instrument of claim 1, wherein the cooling structure comprises a Peltier element.

21. The electrosurgical instrument of any of claims 6 or 11, wherein the surface layer defines an engagement surface for engaging tissue.

22. The electrosurgical instrument of claim 21, wherein the engagement surface is carried on the working end of a probe.

23. The electrosurgical instrument of claim 21, wherein the engagement surface is carried on the working end of a jaw structure, the jaw structure comprising paired first and second jaws moveable between an open position and a closed position.

24. The electrosurgical instrument of claim 23, wherein at least one jaw defines an engagement plane, the engagement plane carrying at least a portion of the engagement surface.

25. The electrosurgical instrument of claim 24, wherein the wherein the cooling structure comprises a thermally conductive material forming an electrode which conducts electrical current from a power source to the PTC matrix.

26. The electrosurgical instrument of claim 25, wherein a plurality of electrodes are formed on the jaw structure, and wherein power is delivered to the electrodes in a bipolar configuration.

27. A method of controlled delivery of energy to tissue, comprising the steps of:

engaging tissue with an engagement surface at least a portion of which comprises a body of temperature-responsive variable impedance material that is intermediate opposing polarity conductor regions operatively coupled to an RF power source;

delivering current flow within the engaged tissue and the engagement surface to cause ohmic heating of the tissue, wherein the ohmically heated tissue conductively heats adjacent regions of the engagement surface, and wherein the engagement surface varies its impedance to modulate current flow between the engagement surface and the tissue; and

contemporaneously cooling the variable impedence body to thereby accelerate modulation of current flow between the engagement surface and the engaged tissue.

28. The method of claim 27, wherein cooling the variable impedance body comprises passively cooling the engagement surface.

29. The method of claim 28, wherein passively cooling the variable impedance body comprises providing a cooling structure at an interior of the working end, wherein the cooling structure comprises a thermally conductive material.

30. The method of claim 28, wherein the cooling structure comprises an electrically conductive material forming an electrode, and wherein delivering current flow comprises delivering RF energy to the engagement surface via the electrically conductive material.

31. The method of claim 27, wherein cooling the variable impedance body comprises actively cooling the engagement surface.

32. The method of claim 31, wherein actively cooling the variable impedance body comprises cooling the engagement surface via a fluid-cooling circulation system.

33. The method of claim 32, wherein cooling the variable impedance body comprises circulating a fluid through a flow channel proximal to the engagement surface.

34. The method of claim 33, wherein cooling the variable impedance body further comprises circulating the fluid through a heat exchanger.

35. The method of claim 33, wherein the fluid comprises water.

36. The method of claim 33, wherein the fluid comprises a cooling gas.

37. The method of claim 36, wherein the cooling gas comprises a cryogen selected from the group consisting of freon or CO_2.

38. An electrosurgical instrument for delivering energy to tissue, comprising:

an introducer member having at least one working surface for engaging tissue, wherein at least a portion of the at least one working surface comprises a polymeric PTC composition; and

a conductor at an interior of the PTC composition, the conductor having at least one open region at an interior of the conductor for cooling the assembly of the conductor and PTC composition.

39. The electrosurgical instrument of claim 38, wherein the conductor comprises an electrically conductive material forming an electrode, the electrode connected to a radiofrequency power source to ohmically heat the tissue.

40. The electrosurgical instrument of claim 39, wherein the conductive material is also thermally conductive to act as a heat sink.

41. The electrosurgical instrument of claim 38, wherein the open region communicates with a fluid-cooling circulation device.

42. The electrosurgical instrument of claim 41, wherein the fluid cooling circulation device comprises a fluid source for providing fluid flow through the at least one open region.

43. The electrosurgical instrument of claim 42, wherein the fluid source communicates with a heat exchange structure.

44. The electrosurgical instrument of claim 43, wherein the fluid comprises water.

45. The electrosurgical instrument of claim 41, wherein the fluid comprises a cooling gas.

46. The electrosurgical instrument of claim 45, wherein the cooling gas comprises a cryogen selected from the group consisting of freon or CO_2.

47. The electrosurgical instrument of claim 40, wherein the working surface defines an engagement surface for engaging tissue.

48. The electrosurgical instrument of claim 47, wherein the engagement surface is carried on the working end of a probe.

49. The electrosurgical instrument of claim 47, wherein the engagement surface is carried on the working end of a jaw structure, the jaw structure comprising paired first and second jaws moveable between an open position and a closed position.

50. The electrosurgical instrument of claim 49, wherein at least one jaw defines an engagement plane, the engagement plane carrying at least a portion of the engagement surface.